Space Weather Technical Forecast

Issued on Sunday, 13 February 2022 at 12:31 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Reducing Chance of Minor R1 Radio Blackouts. Rising Chance of Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low with several C class flares observed. The largest of which was a C9.2 at 12/1708 UTC. The source of this flare was beyond the west limb of the visible disk. There are currently three sunspot regions on the Earth facing side of the Sun. AR2941 has developed a delta configuration within its intermediate spots and is now a mature Fki/Beta-Delta. The other two regions AR2945 and 2946 are both relatively weak and stable.
The past 24 hours have seen numerous apparently minor Coronal Mass Ejections (CMEs) on coronagraph imagery. None of these appear to have an Earth-directed component, emanating mostly in the rear-facing western quadrant. In particular, there is an absence of any westward-directed ejecta on STEREO A COR2 imagery (i.e. potentially in the Earth sector). At present no confirmed Earth-directed Coronal Mass Ejections (CMEs) were in evidence, but confidence is lower than average.

Solar Wind / Geomagnetic Activity: Solar winds, as measured DSCOVR at L1, has remained elevated but with an overall declining trend, ending the period around 520 km/s. The source of this fast wind is probably related to CH53/-, with the phi angle accordingly negative (towards the sun). Density was mostly near, or slightly above, average. The IMF was weak and peaked around 8nT, with a range in north-south component (Bz) from +8nT to -6nT. The net result of the above solar wind measures was Quiet to Unsettled geomagnetic activity (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at Background levels. The high energy electron flux (greater than 2MeV) was at Background to Moderate levels during the past 24 hours. The corresponding 24-hour integrated electron fluence values remained below the 1e8 Active level, though have been on a rising trend since 13/0001Z. 1.17e7 integrated pfu observed at 13/0001UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to remain mostly Low through the next four days, but with a Chance (30%) of M-class flares. Further sunspots are expected to rotate around the eastern limb, and confidence is therefore rather low.

Solar Wind / Geomagnetic Activity: No CMEs feature in this forecast period, although confidence in this is somewhat lower than usual owing to imagery gaps. The current high speed stream is thought most likely to be the expected CH53, and elevated or slightly-elevated solar winds are likely for much of the period, perhaps with a declining trend, this will result in generally Quiet to Unsettled geomagnetic activity, with the greatest chance of Active intervals on days 1 and 2 (13 and 14 Feb).

Energetic Particles / Solar Radiation: High energy proton flux is most likely to remain at Background levels, but with a daily Slight Chance of S1. The high energy electron flux is expected to slowly increase with breaches of the 1000 pfu High threshold likely around the diurnal maximum each day.

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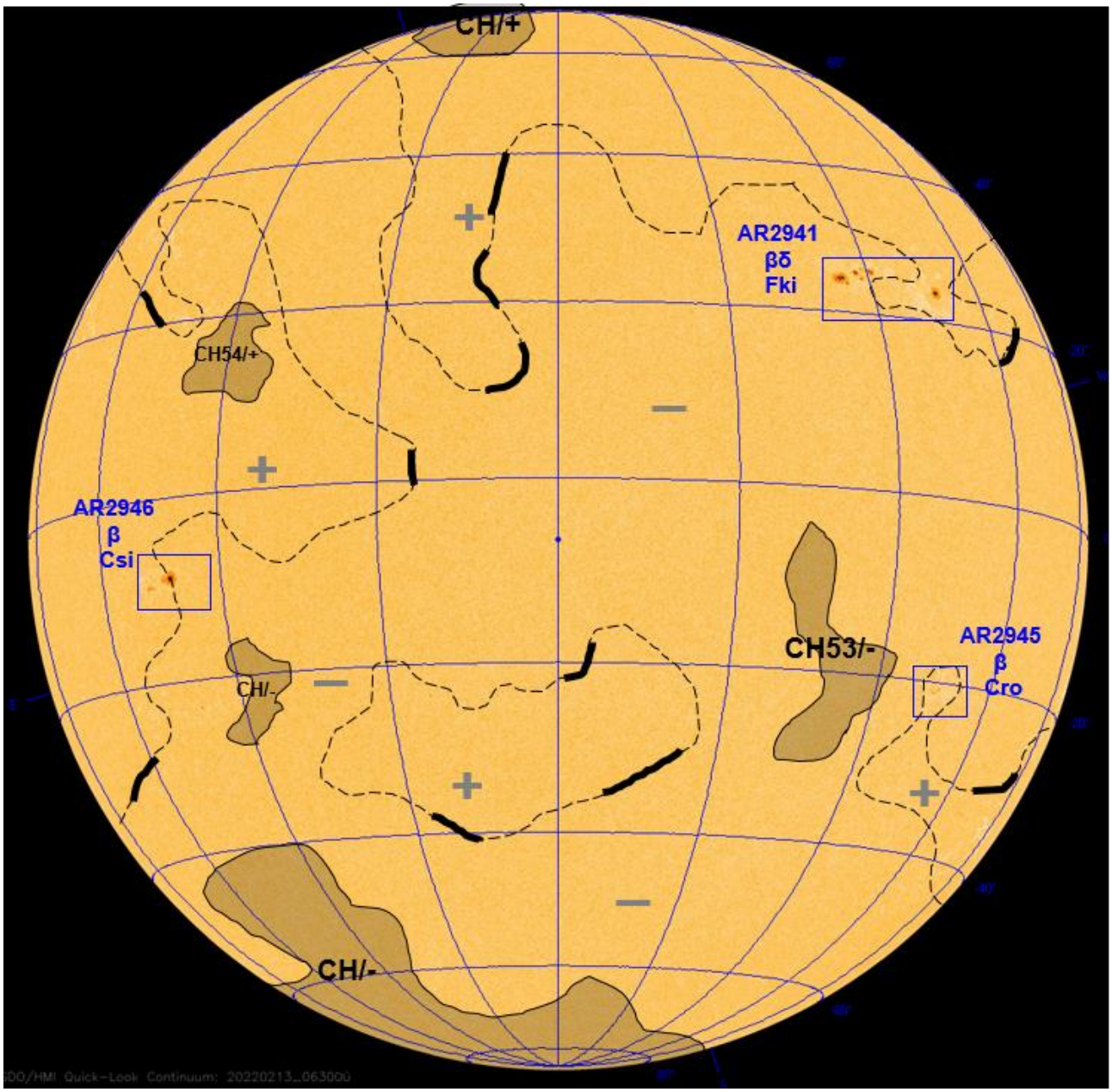
Figure 1. Solar Analysis Valid 13/0800 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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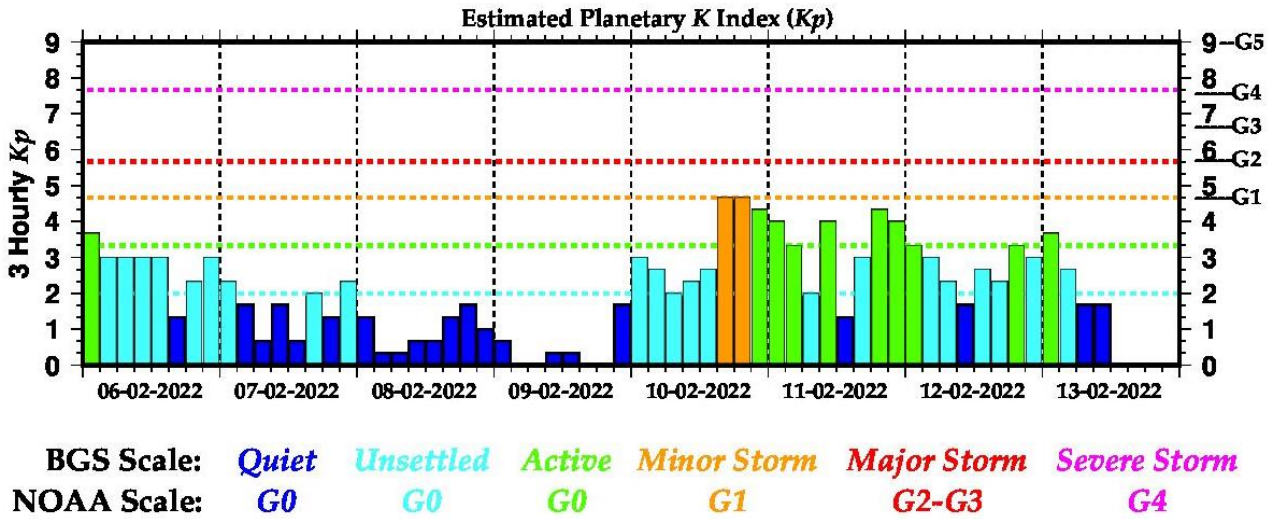
Geomagnetic Storms:

No CMEs feature in this forecast at present, however confidence in this is somewhat lower than usual given numerous (particularly westward) CMEs with imagery gaps hampering analysis. Earth is now under the influence of a high speed stream (HSS) and the cause of this is thought most likely to be CH53, which is similar to persistence. Geomagnetic activity has probably peaked and with no further fast wind features, although there is the caveat that recent minor transients may pollute the forecast, lowering confidence. The forecast is for Quiet to Unsettled activity and the greatest chance of Active intervals is likely to be on days 1 and 2 (13 and 14 Feb).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Figure 2: BGS Planetary Kp.



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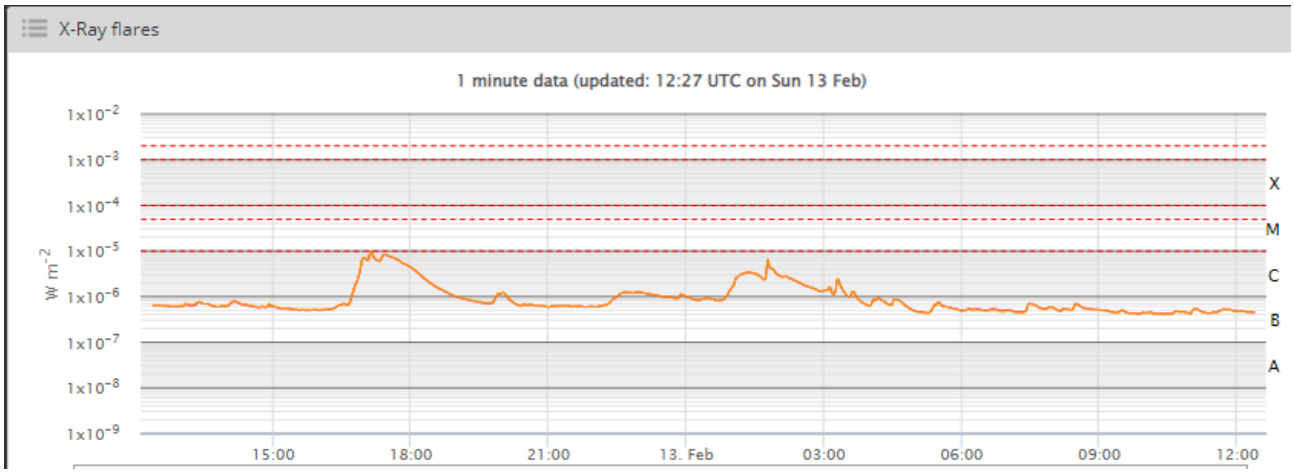
Radio Blackouts - X-Ray Flares:
The balance of sunspot groups should enter a state of flux over the forecast period. Returning regions Ex-2935 and Ex-2934 should begin to rotate onto the visible disc, with both appearing on far-side soundings and EUV imagery. This is in contrast to the depopulation expected to occur of the current western limb. This is all happening in the context of a changing disc, with flaring being observed from sources beyond the west limb as well as AR2941.
The X-ray forecast on balance starts with a daily Chance of M-class flares, reducing to a Slight Chance by days 3 and 4 (15 and 16 Feb), however this may be revised further downwards should the eastern horizon spots fall short of expectations as the western limb quietens down.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	25	15	10
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 3: GOES16 X-ray flares.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. Solar radiation storms are not expected in the period. However, there is a very slight chance for proton fluxes to rise given any significant flaring from regions close to the western limb.

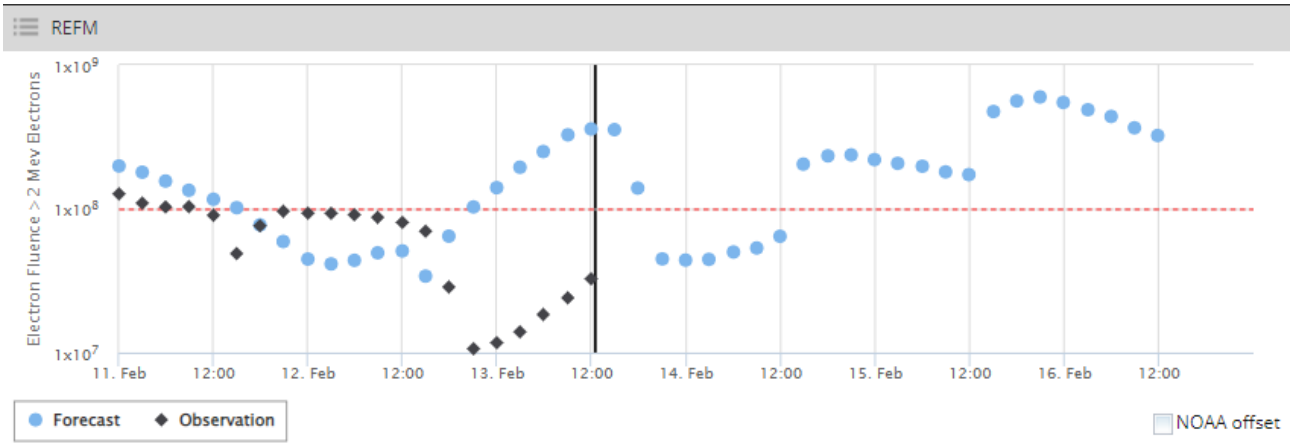
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

Confidence in the electron forecast is now rising, with the current coronal hole fast wind so far proving similar on this pass to last rotation, now assumed to be CH53. This feature's predecessor saw eventual marginal exceedence of the Active 24-hour integrated fluence threshold. This gives a rising probability of exceedence of Active from current levels in the four-day period, with the caveat of minor transient activity perhaps polluting the forecast later in the four days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	50	70	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REF Model- Somewhat erratic, but on an increasing trend.



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